PAT FERRARO

SANTA CLARA COUNTY FLOOD CONTROL
AND
WATER DISTRICT

REPORT
ON
PROPOSED IMPROVEMENTS
ON
NORWOOD CREEK

(REVISION OF 1969 REPORT)

INCLUDING ENVIRONMENTAL IMPACT REPORT

ZONE E-1 AND ZONE E-3

PROJECT NUMBER 40042

JULY 1973

TC
425
N67.R4
1973
REF

TC425N67K419726.3

SANTA CLARA COUNTY FLOOD CONTROL
AND
WATER DISTRICT

EAST ZONE FLOOD CONTROL ADVISORY COMMITTEE

REPORT
ON
PROPOSED IMPROVEMENTS
ON
NORWOOD CREEK
(REVISION OF 1969 REPORT)

ZONE E-1 AND ZONE E-3

PROJECT NUMBER 40042

Donald K. Currlin, General Manager

Lloyd C. Fowler, Chief Engineer

DISTRICT BOARD OF DIRECTORS

MAURICE E. DULLEA, CHAIRMAN	DISTRICT 4	JOE CHIRI, VICE CHAIRMAN	DISTRICT 1
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SANTA CLARA COUNTY
FLOOD CONTROL
WATER DISTRICT

5750 ALMADEN EXPRESSWAY • SAN JOSE, CALIFORNIA 95118 • (408) 265-2600

DONALD K. CURRLIN GENERAL MANAGER

June 5, 1973

The Honorable Board of Directors
Santa Clara County Flood Control
and Water District
5750 Almaden Expressway
San Jose, California 95118

Gentlemen:

Transmitted herewith is the Engineer's Report on proposed improvements to Norwood Creek, Project Number 40042, from its proposed confluence with Thompson Creek to the foothills. This project is in Zone E-1 (East) of the Santa Clara County Flood Control and Water District. This report is an updating of a previous report on which a public hearing was held and the report adopted by the Board of Directors. The updating is required to include desirable design changes as well as a new means of financing the project.

This report describes the proposed flood prevention improvements consisting of trapezoidal earth channel sections, rock-lined sections, concrete pipe, drop structures, energy dissipators, and a sediment control facility. These improvements extend from Thompson Creek upstream over a 13,000-foot reach of Norwood Creek. The estimated cost of the proposed improvements is $1,371,000.

The proposed improvements, when constructed, will prevent major flooding in the floodplain areas of Norwood Creek. Utilizing the concept of creating a new Flood Control Zone (E-3) together with the agreement which calls for the property owner group ("Venture") to advance the funds needed for construction of the project and the City of San Jose to administer the fee collection to repay the "Venture" is the most expeditious method to complete the needed flood control project.

I concur in the project as proposed and recommend a public hearing to be held as a fulfillment of the existing contract between the City of San Jose, the Venture and the District.

Sincerely yours,

Donald K Currlin

General Manager

Enclosure

TABLE OF CONTENTS

Page

Introduction 1

Description of Watershed 3

Design Criteria 5

Description of Proposed Project 7

Project Costs and Financing 11

Proposed Flood Control Zone (E-3) 13

Conclusions and Recommendations 15

TABLES

Table

1 Peak Flows for Design Flood 6

2 Project Cost and Construction Staging 11

PLATES

Plate

1 Title Sheet

2 Watershed Map

3 Plan and Profile (Station 0+00 to Station 26+25)

4 Plan and Profile (Sta. 26+25 to Sta. 57+50/58+28)

5 Plan and Profile (Station 58+28 to Station 89+30)

6 Plan and Profile (Station 89+30 to Station 123 +00)

7 Plan and Profile (Station 123+00 to End of Project)

INTRODUCTION

This report is an updating of a previous report approved by the Board of Directors of the Santa Clara County Flood Control and Water District after a public hearing on September 23, 1969. The updating is required to include desirable design changes as well as a new means of financing the project.

Norwood Creek is located in the East Zone of the Santa Clara County Flood Control and Water District, with the major portion of its watershed in the unincorporated territory and the balance in the City of San Jose. The existing creek originates in the foothills east of San Jose and flows in a defined channel until it enters the valley floor. As the creek leaves the foothills, the grade flattens and the channel becomes nonexistent causing the flow to spread, resulting in sheet overland flow. This overland flow, during large events, outfalls into Thompson Creek and eventually reaches Coyote Creek. The Norwood Creek watershed is bound on the north by the Ruby Creek watershed and on the south by the Quimby Creek watershed.

Norwood Creek has a small drainage area of 2.25 square miles but it has a high flood potential because of the steep watershed slopes and lack of a defined channel in the lower reaches. The surrounding area is rapidly urbanizing and additional development in the the watershed will increase the potential flood damages. Therefore, in order to eliminate the potential flood hazard and provide an outfall for local drainage, the capacity of Norwood Creek to contain floods must be improved. Alternative types and combinations of improvements have been studied to develop the most economical solution to the problem. This report presents the results of these studies and consists of:

1. A general description of the watershed and the flood problems, together with plans delineating the proposed improvements.

2. A discussion of the proposed project with plates showing plans, profiles, typical cross-sections and rights of way.

3. An estimate of the costs of the proposed project and suggested means of financing these costs.

4. A discussion of the contemplated method of project financing including the establishment of a benefit district or zone.

DESCRIPTION OF WATERSHED

The Norwood Creek watershed has a drainage area of 2.25 square miles with about 60 percent of this area in the steep foothills and the balance in the relatively flat valley floor now used for orchards or vineyards. At the present time there are only scattered homes in the watershed and the valley portion is primarily used for orchards or vineyards. The major existing streets in the watershed are Norwood Avenue, Quimby Road and White Road. Some subdivisions are now being planned and it is anticipated that most of the lower area will be developed into an urban community.

Plate 2 is a map showing the Norwood Creek watershed and illustrating the general topography of the area. This entire basin has a mean annual precipitation of about 18 inches. The upper portion of the Creek is divided into two branches, with the north branch having a drainage area of 625 acres and the south branch draining 120 acres. The south branch under existing conditions will flow into the Quimby Creek watershed.

In the foothill area of the drainage basin, which ranges up to elevation 2,400, residual soils consist of clay and fine sandy and clayey silt overlying soft shale and sandstone bedrock. These soils are low to moderately permeable, and this helps absorption capacity to reduce peak flows of low intensity. The remaining portion of the basin occupies part of an older alluvial fan. Surficial soils consist of clay and clayey gravel, and are moderately permeable, with the exception of the area downstream from White Road where clay and silty clay are predominant.

The native growth in the hills is a fairly heavy cover of grass with some trees and shrubs in the canyons. This type of vegetation, especially on the more permeable soils, has a considerable effect on reducing runoff for low rainfall intensities but has little effect on the higher intensity rainfall which produces the design flood flows.

DESIGN CRITERIA

The criteria used in the design of the Norwood Creek flood control improvements followed accepted engineering standards. Conservative values of roughness (representing the friction along the channel banks and bottom) were used in the hydraulic design to allow for some deterioration in channel smoothness with time. Economic evaluations of alternative channel designs were based on estimates of construction costs including engineering and inspection costs, right of way values, and the present worth of future maintenance costs.

Completed improvements will provide a level of protection designed to safely convey a one-percent flood (the so-called 100-year recurrence frequency flood) to a point of disposal. The design flood flows meeting this standard for Norwood Creek were computed using the results of a regional flood frequency hydrologic analysis. This multiple correlation analysis, based on data from gaged watersheds, was utilized to determine the peak flood flow in accordance with tributary area, mean annual precipitation, and basin shape. The resulting computed design flows are given in Table 1.

TABLE 1

Design Flood Flows

Location	Watershed Area Acres	Peak Flows, CFS Design (1)	Peak Flows, CFS Upper Limit (2)
Thompson Crk. to 500' west of Flint Avenue	1444	420	630
To contour elev. 400	1091	400	600
To Mt. Pleasant Road	770	320	470
South Branch	120	70	100

(1) Design flow is the one-percent flood or 100-year recurrence frequency.

(2) Upper Limit is the expected flood flow at the 80% confidence level for the 100-year recurrence frequency event, and is used to ascertain the adequacy of the channel section including freeboard.

DESCRIPTION OF PROPOSED PROJECT

Proposed improvements to Norwood Creek extend over a length of about 13,000 feet upstream from its confluence with Thompson Creek to a sediment control facility near Mt. Pleasant Road. These proposed improvements include earth channel sections, rock lined sections, drop structures, energy dissipators, concrete pipe, and a sediment control facility. The proposed improvements are illustrated in plan and profile on Plates 3 through 7 and discussed by reaches as well as a discussion of other alternatives investigated.

Proposed Project

Reach 1:

The required structure at the confluence of Norwood and Thompson Creeks will be a part of the Thompson Creek project. Between Station 1+00 and 1+50 are Pacific Gas and Electric gas lines which the creek will go under in a reinforced concrete box with warped inlet and outlet wingwalls. Upstream from the confluence from Station 0+50 to Station 31+50 a trapezoidal earth channel section is proposed. A drop structure is proposed at Station 23+00 so that the design channel velocities will not cause erosion. A depressed maintenance road is proposed to decrease the visual impact of maintenance work, on adjacent property owners. The side slope from the depressed road to the right of way line will be landscaped to screen the channel and the right of way will be fenced.

Reaches 2, 3, and 4:

Near Station 31+50 just downstream of White Road, the channel section will transition to a reinforced concrete pipe along Norwood Road. An energy dissipator would be installed at the outfall end of the concrete pipe to reduce discharge velocities. The pipe will then continue easterly up Norwood Avenue. At a point near Station 97 the pipe would leave Norwood Road and turn south to a point near Station 105+00 where the pipe turns easterly and extends across the proposed extension of Tully Road to a terminal point at the sediment control facility.

Reaches 5 and 6:

The location of the sediment control facility is where the existing stream channels have adequate carrying capacity and where diversion channels will be constructed to outfall into the sediment control facility. The sediment control facility is necessary to trap all bed load rocks and gravel along with large suspended materials and debris that may otherwise deposit in the downstream improvements. To protect the diversion channels from erosive velocities the channels will be rock lined over their entire length. The sediment control facility would be provided with landscaping around its perimeter and the diversion channels would also have landscaping on both sides of the channel.

The 120-acre watershed of the south branch which now drains into the Quimby Creek channel would be diverted to the Norwood Creek sediment control facility. This diversion provides the most economical solution to the problems in both watersheds.

Alternatives Investigated

During the preparation of the Norwood Creek planning report several alternative courses of action were considered that would or would not provide adequate flood protection in the area. The District environmental impact report discusses the do-nothing alternatives and this report discusses feasibility of various structural improvement alternatives.

Use of either a concrete lined channel or rock lined channel over the entire length of the project was considered. This alternative however, was more expensive than the proposed plan and would have a more damaging effect on the environment. A sediment control facility would still be required with this alternative because of sediment build up if debris were not kept out of the channel.

An earth channel was also considered over the entire project length rather than just from the Thompson Creek confluence to White Road. This alternative was also more expensive than the proposed plan since a large number of drop structures would be required upstream of White Road because of the steep ground slope. The earth channel could be landscaped to mitigate its effect on the environment. The drop structures, however, would appear to have a more damaging effect on the environment both visually and from a public hazard point of view. The one advantage of this alternative would be that the sediment control facility could be moved downstream from its present location to one that would perhaps have not as much visual impact on the area. In this alternative, consideration was also given to the possible use of drop structures to act as sediment retention structures and not have a single sediment control facility. This would require constant excavation of the silt deposition from the earth channel with consequent higher maintenance costs. This would also have a more damaging effect environmentally on an earth channel as any vegetation along the channel that would be established would constantly be silted over or be removed.

Due to the fact that there is no existing defined channel in the valley floor areas (or project area) no alternative plan to preserve the existing stream and its environment, such as a floodplain, was considered.

PROJECT COSTS

Estimates of the cost of construction of the proposed flood control facility improvements to Norwood Creek were made using 1973 prices. A contingency item was estimated to account for the costs of engineering, construction inspection, advertising, legal fees, and other incidentals. The estimated costs are presented in Table 2.

TABLE 2

Estimated Project Costs

Reach	Station Limits	Construction	Engineering & Conting.	R/W	Total
1	0+00 to 31+50	$111,700	$ 39,100	$125,400	$ 276,200
2	31+50 to 54+00	218,100	76,300	-	294,400
3	54+00 to 105+50	346,000	121,100	3,500	470,600
4	105+50 to 124+10	71,900	25,100	7,000	104,000
	Sedimentation Facility	39,800	13,900	92,400	146,100
5	0+00 to 5+80	23,400	8,200	11,000	42,600
6	0+00 to 3+00	23,400	8,200	5,500	37,100
	TOTAL	$834,300	$291,900	$244,800	$1,371,000

The current assessed valuation of the East Zone (E-1) and the existing tax rate will not provide an adequate source of funds to complete all East Zone projects in the next few years. Normally, therefore, a bond issue would have to be approved for this project to be constructed in the near future. However, an agreement has been formulated which provides that the cost to construct this project be advanced by a group of local property owners. This method of financing the improvement of a flood control facility is acceptable to the District.

PROPOSED FLOOD CONTROL ZONE (E-3)

Under the concept of creating a new Flood Control Zone (E-3), the proposed project would be constructed by private financing under provisions of an agreement between the City of San Jose, the Flood Control District, and a joint venture of sponsoring private property owners.

The zone boundaries would be established by legal proceedings of the Flood Control District creating a zone.

Upon creation of the zone, completion of a successful public hearing on the Engineer's Report and plans, and circulation and adoption of the environmental impact report by the District Board, the project, if then approved, would be designed and constructed by the joint venture under District supervision and inspection. Upon completion of the project and the establishment of total project costs a rate per area would be established as a reimbursement fee.

The reimbursements would be collected and/or credited as the various properties develop within Zone E-3 boundaries. The established reimbursement fees would be collected by the City of San Jose and appropriate disbursements made to the joint venture.

An additional provision of the agreement between the "Venture", the City of San Jose, and the District is that if District shall determine to call and shall call a bond election for purposes which include repayment of funds advanced for the project and shall receive the requisite consent of the voters thereto, District will pay a sum equal to the final cost of the project to City from the proceeds of such bonds and City will thereupon end its collection pursuant to this agreement and City agrees to make repayment, from such proceeds, as the agent of District, to persons and agencies who have theretofore borne such costs in the amount advanced or paid by each of them.

The establishment of Zone E-3 is for the purpose of financing the initial construction. The existing Zone E-1, which includes Zone E-3 within its boundaries, will be used as the basis for collecting funds for the operation and maintenance of the project upon its completion.

CONCLUSIONS AND RECOMMENDATIONS

As a result of the investigation of Norwood Creek reported herein it is concluded that:

1. There is no existing channel for run-off from the Norwood Creek watershed below about Station 78+00, and flood damage will increase as the area urbanizes.
2. The existing channel above Station 78+00 to about Station 115+00 is inadequate to prevent flood damage and is subject to severe erosion problems because of the steep natural gradient.
3. The most economical solution to the flood control problems would be to construct about 3200 feet of channel, 9300 feet of concrete pipe, 900 feet of rock lined channels, one sediment control facility and appurtenant structures.
4. There is room in the open channel right of way for landscaping the creek side slopes and the side slopes from the depressed maintenance road to the right of way line. The additional costs for the landscaping were included in the project costs.
5. The estimated construction cost including contingencies and rights of way is $1,371,000.

6. Utilizing the concept of creating a new zone (Zone E-3) together with the agreement of the "Venture" to advance the funds needed for immediate construction of the project and the City of San Jose to administer the fee collections to repay the "Venture" is the most expeditious method to complete this needed flood control project at this time.

Based on these conclusions it is recommended that the most appropriate flood control improvements on Norwood Creek are as proposed herein. The potential adverse effects on Silver Creek flooding by development of this tributary must be given due consideration in relation to the timing of construction of Norwood Creek.

Submitted by:

John L. Richardson

John L. Richardson
Head, Project Development Branch
(Project Coordinator)

Approval recommended:

George Korbay

George Korbay
Design and Construction Manager

Approved:

Lloyd C. Fowler

Lloyd C. Fowler
Chief Engineer

MAP AND GENERAL PLAN

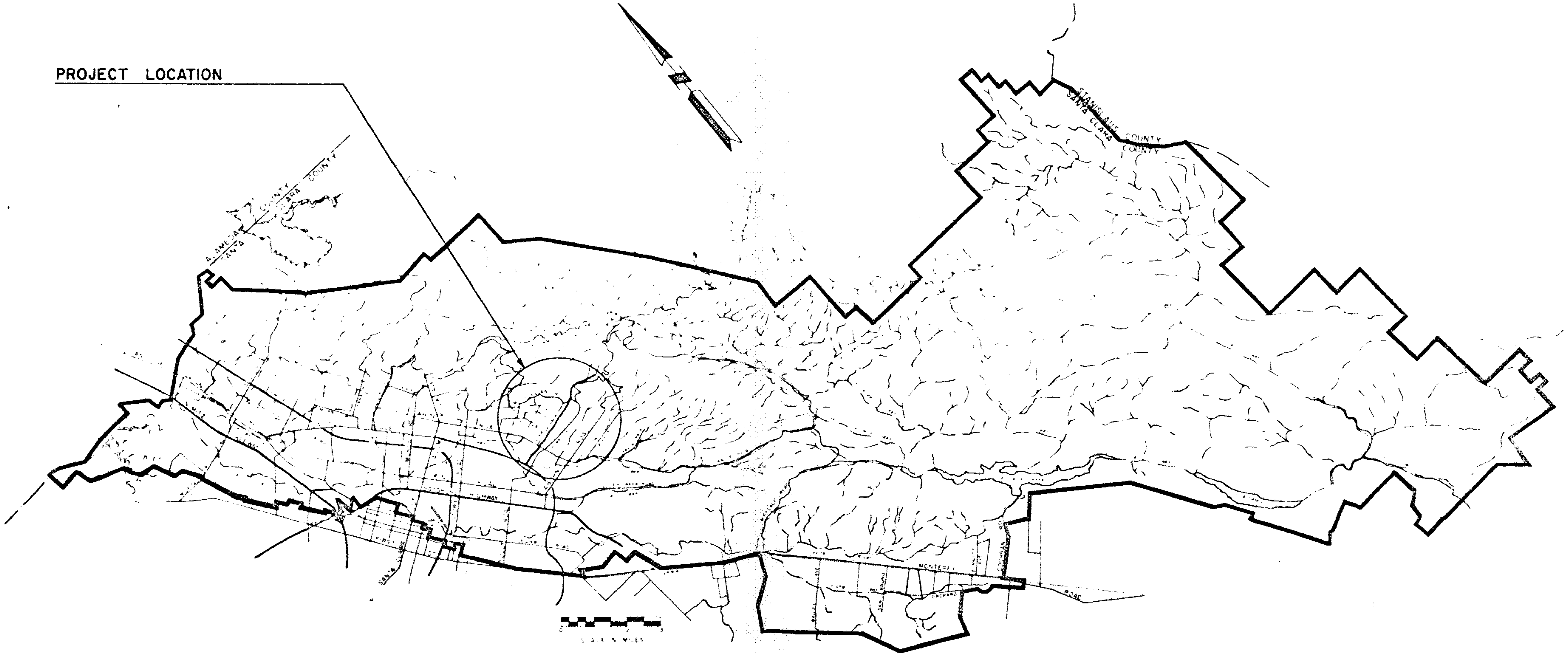
FOR

NORWOOD CREEK

FROM THOMPSON CREEK TO 13,000 FEET UPSTREAM

SANTA CLARA COUNTY FLOOD CONTROL
AND
WATER DISTRICT

EAST FLOOD CONTROL ZONE E-1 **PROJECT NO. 40042**



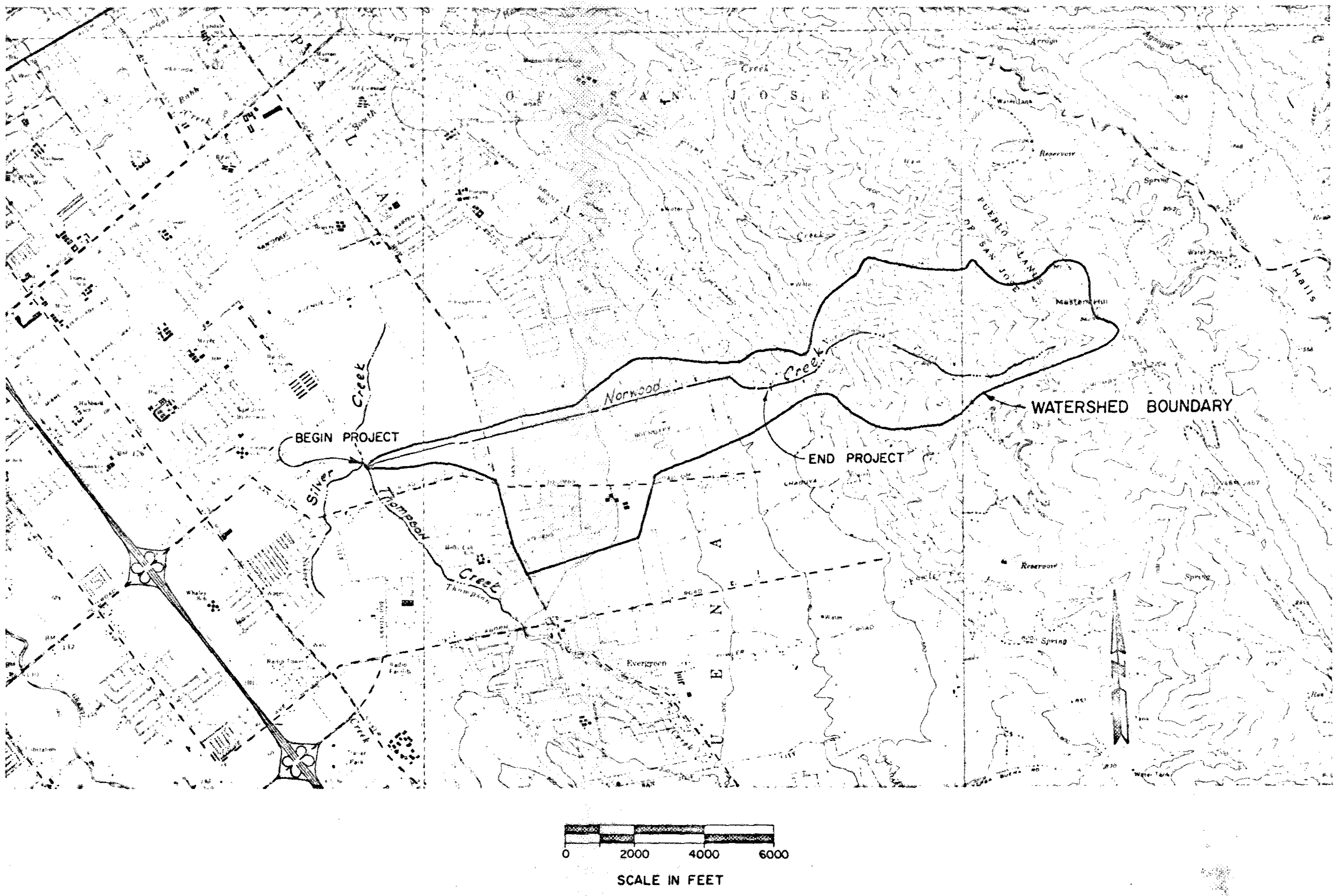
PROJECT APPROVAL:

DESIGN AND CONSTRUCTION MANAGER

Lloyd Fowler
CHIEF ENGINEER

Donald K. Currlin
GENERAL MANAGER

DATE: 5/29/73



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REFER TO TRACING FOR LATEST REVISION

REFERENCE INFORMATION AND NOTES

LEGEND

- - - - - PROJECT ROUTE
——— WATERSHED BOUNDARY
TOTAL AREA = 1444 Ac.

DATE 5-29-73
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SANTA CLARA COUNTY FLOOD CONTROL
AND
WATER DISTRICT

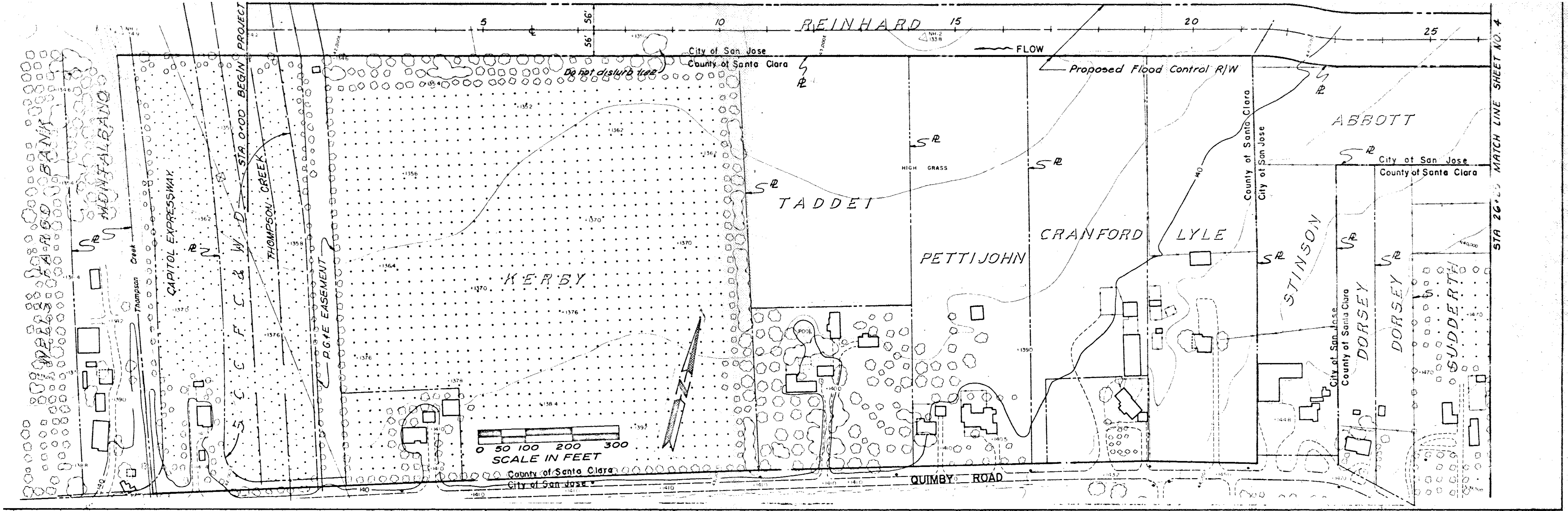
ENGINEERING CERTIFICATION
PROJECT ENGINEER
W. F. Carlson
DIVISION ENGINEER R.C.E. NO. 16684

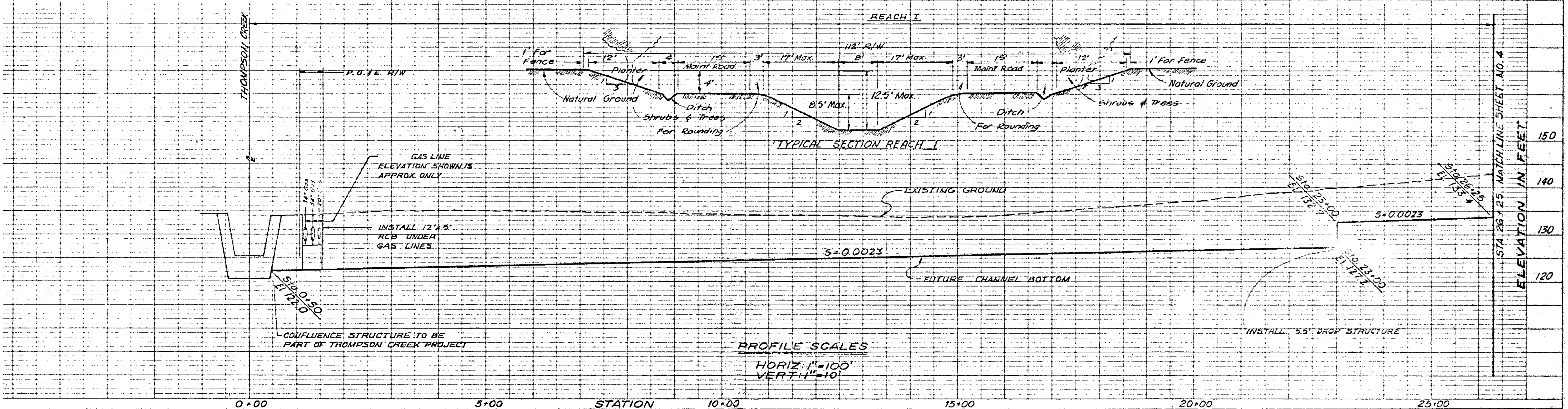
ENGINEERING APPROVAL
John L. Richardson
HEAD, PROJECT DEVELOPMENT BRANCH R.C.E. NO. 17646

MAP AND GENERAL PLANS
ZONE E-1 (EAST) PROJECT NO. 40042

NORWOOD CREEK
WATERSHED

SCALE AS SHOWN
SHEET 2 of 7





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SANTA CLARA COUNTY FLOOD CONTROL
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PROJECT ENGINEER
W. F. Carlsen
DIVISION ENGINEER R.C.E. NO 16684

ENGINEERING APPROVAL
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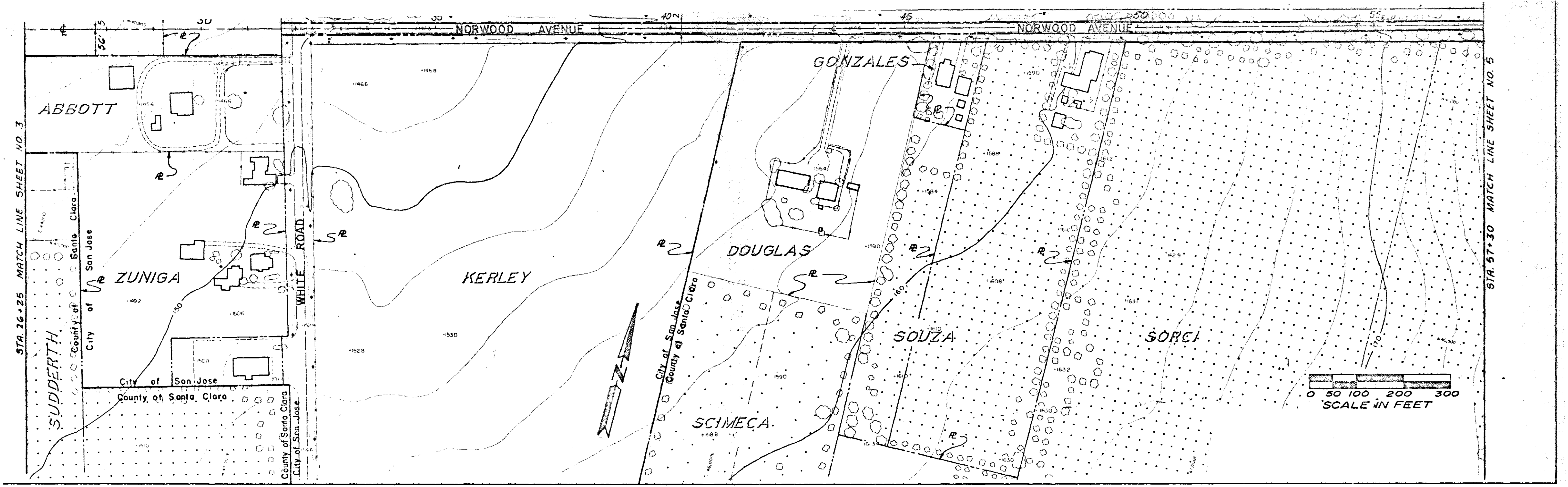
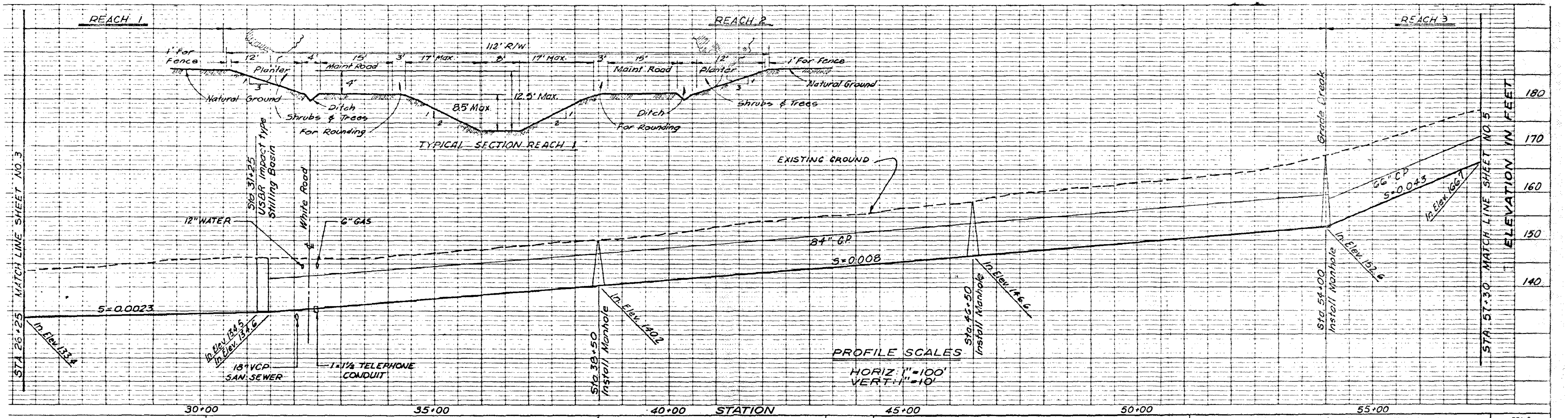
MAP AND GENERAL PLANS
ZONE E-1 (EAST) PROJECT NO. 40042

NORWOOD CREEK

SCALE AS SHOWN
SHEET 3 of 7





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DATE 5-29-73

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DRAWN MH

CHECKED JLR

SANTA CLARA COUNTY FLOOD CONTROL AND WATER DISTRICT

ENGINEERING CERTIFICATION

PROJECT ENGINEER W. F. Carlsen

DIVISION ENGINEER R.C.E. NO. 16684

ENGINEERING APPROVAL

John L. Richardson

HEAD, PROJECT DEVELOPMENT BRANCH R.C.E. NO. 17646

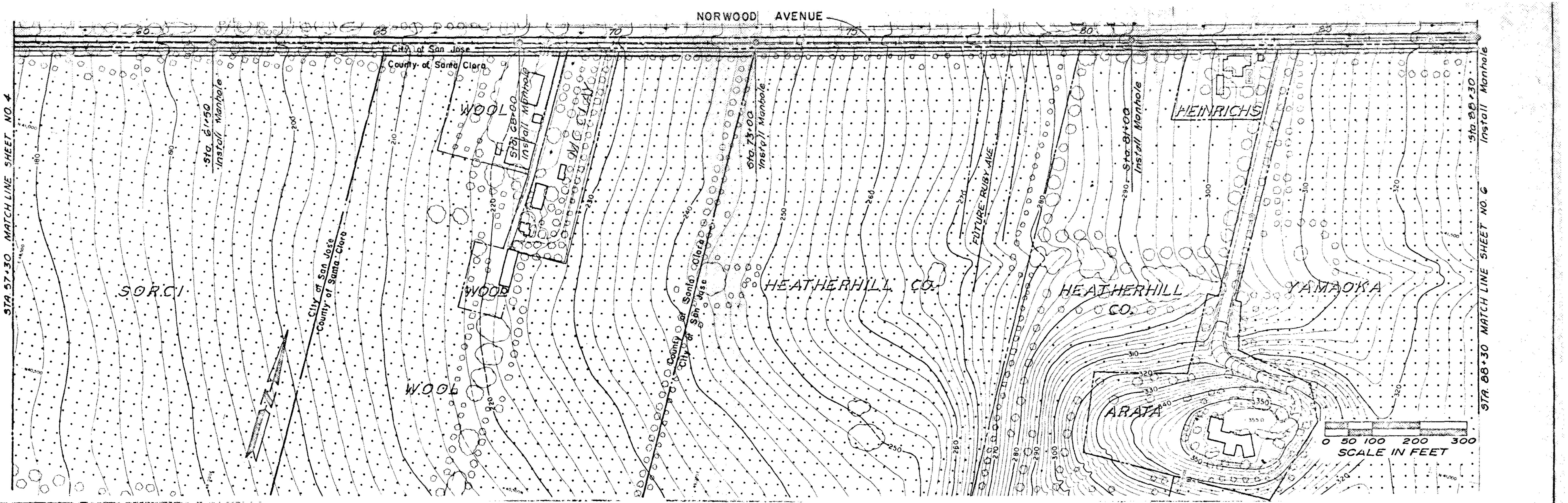
MAP AND GENERAL PLANS

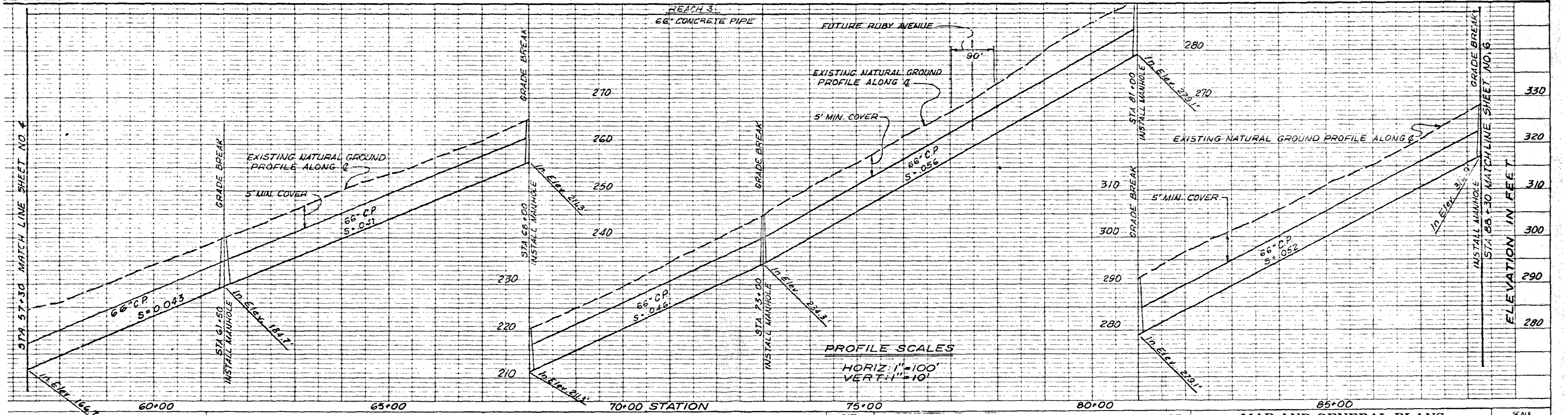
ZONE E-1 (EAST) PROJECT NO. 40042

NORWOOD CREEK

SCALE AS SHOWN

SHEET 4 of 7





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SANTA CLARA COUNTY FLOOD CONTROL
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John L. Richardson
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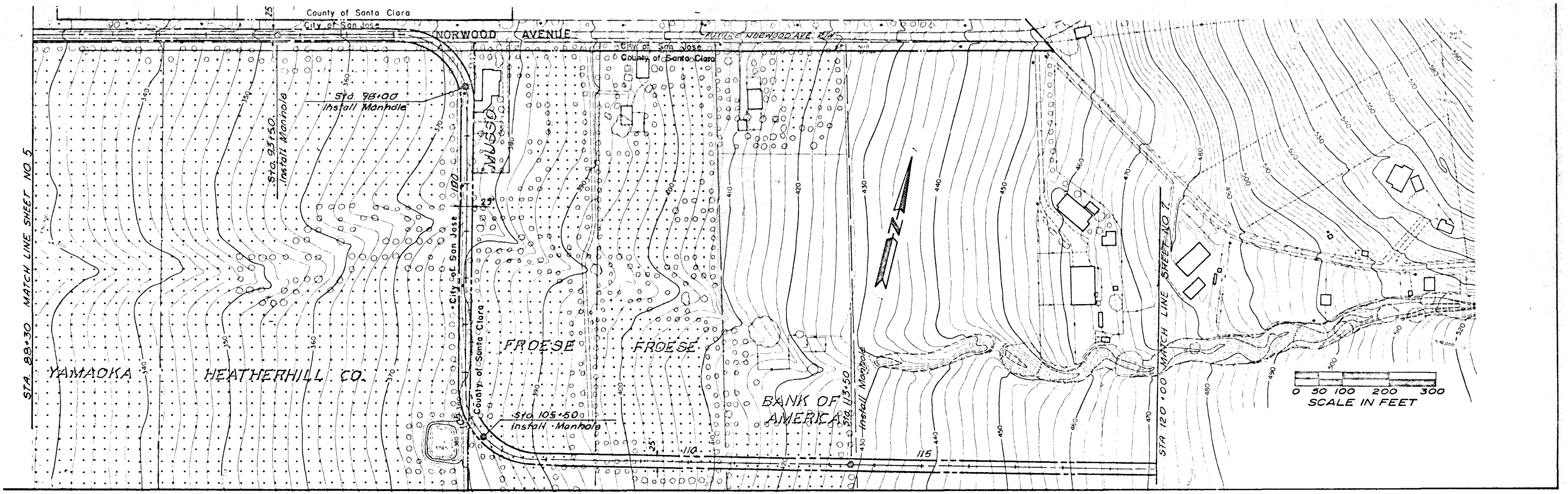
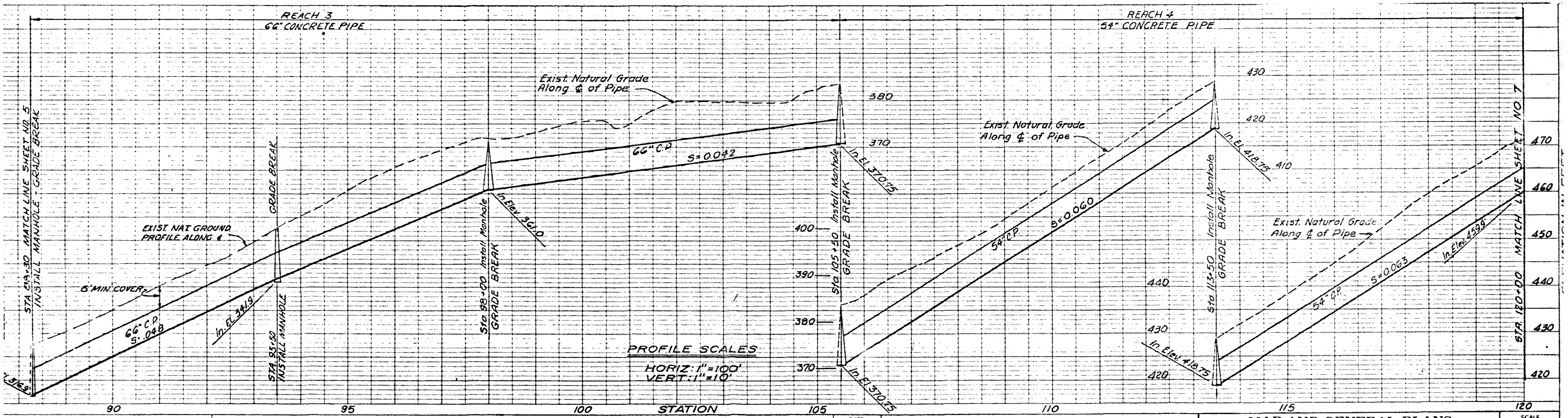
MAP AND GENERAL PLANS
ZONE E-1 (EAST) PROJECT NO. 40042

NORWOOD CREEK

SCALE AS SHOWN
SHEET 5 of 7




REACH 3
66" CONCRETE PIPE
REACH 4
54" CONCRETE PIPE
Exist. Natural Grade Along ¢ of Pipe
Exist. Natural Grade Along ¢ of Pipe
Exist. Natural Grade Along ¢ of Pipe
EXIST. NAT. GROUND PROFILE ALONG ¢
STA. 88+30 MATCH LINE SHEET NO. 5 INSTALL MANHOLE - GRADE BREAK
GRADE BREAK
STA. 93+50 INSTALL MANHOLE
In. EL. 341.9
6' MIN. COVER
66" C.P.
S: .048
Sta. 98+00 Install Manhole GRADE BREAK
In. Elev. 361.0
66" C.P.
S=0.042
Sta. 105+50 Install Manhole GRADE BREAK
In. El. 370.75
In. El. 370.75
54" C.P.
S=0.060
Sta. 113+50 Install Manhole GRADE BREAK
In. El. 418.75
In. Elev. 418.75
54" C.P.
S=0.063
In. Elev. 459.8
STA. 120+00 MATCH LINE SHEET NO. 7
PROFILE SCALES
HORIZ: 1"=100'
VERT: 1"=10'
STATION
90
95
100
105
110
115
120
370
380
390
400
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430
440
450
460
470

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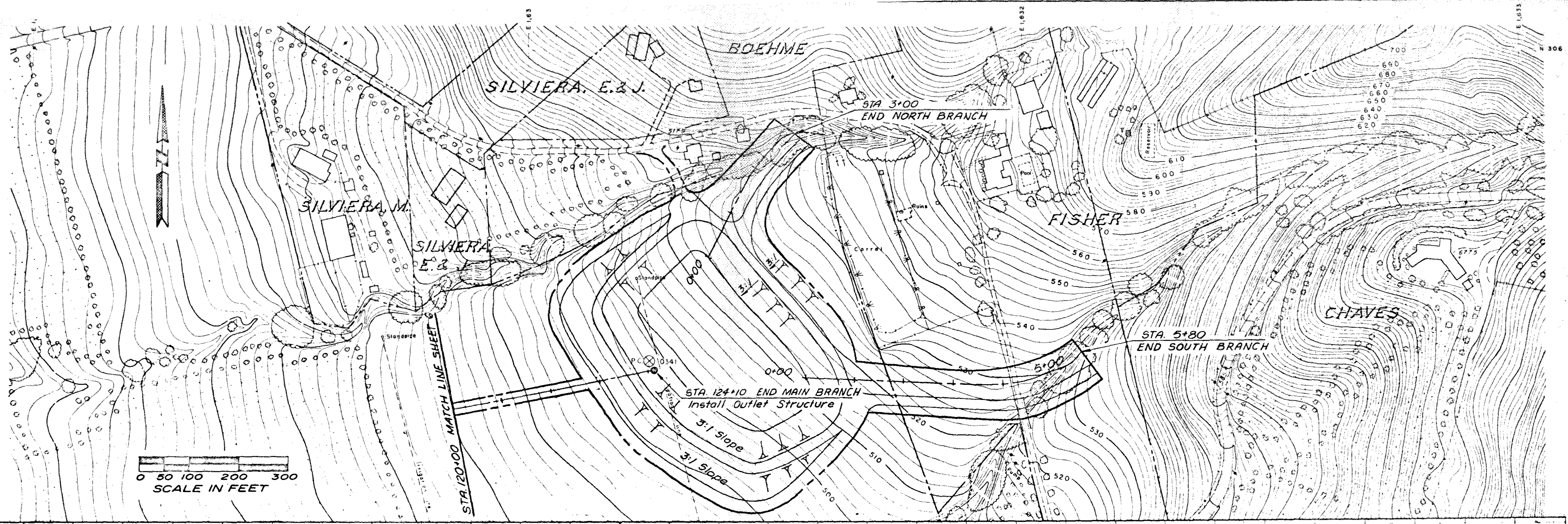
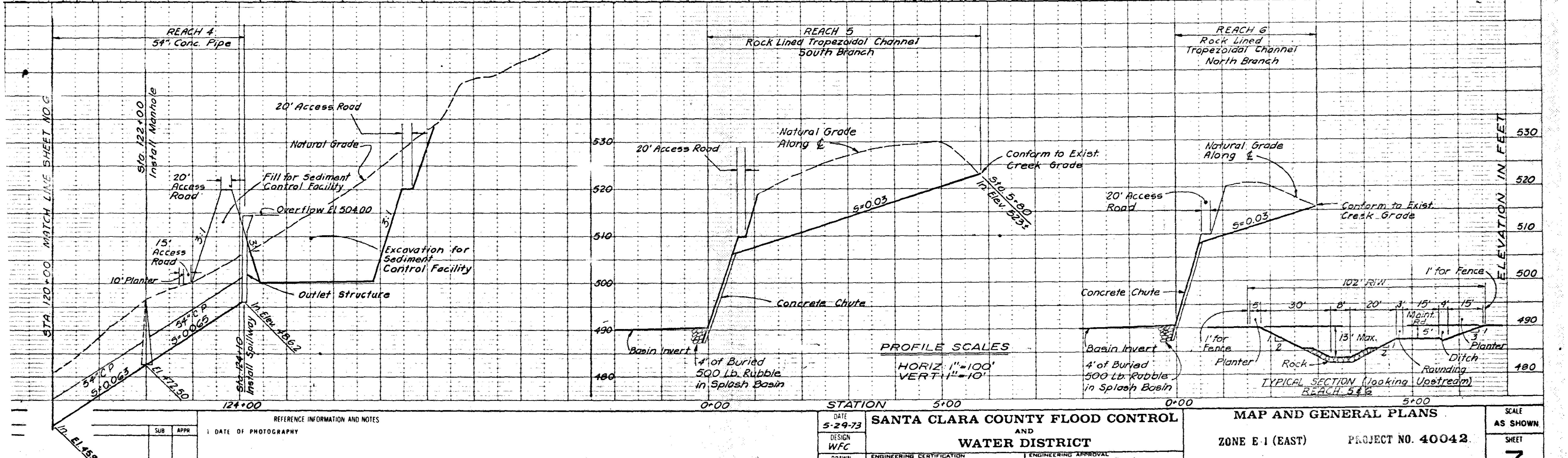
MAP AND GENERAL PLANS

ZONE E-1 (EAST) PROJECT NO. 40042

NORWOOD CREEK

SCALE AS SHOWN
SHEET 6 of 7





SUB	APPR	REFERENCE INFORMATION AND NOTES
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DESIGN WFC			ZONE E-1 (EAST) PROJECT NO. 40042	SHEET
DRAWN JF	ENGINEERING CERTIFICATION	ENGINEERING APPROVAL	NORWOOD CREEK	7 of 7
CHECKED JLR	PROJECT ENGINEER W. F. Carlsen DIVISION ENGINEER R.C.E. 16684	John L. Richardson HEAD, PROJECT DEVELOPMENT BRANCH R.C.E. NO. 17646		

DRAFT

ENVIRONMENTAL IMPACT REPORT

Relative to

Flood Control Improvements

on

NORWOOD CREEK

from Thompson Creek to 13,000 feet upstream

Zone E-1 and proposed Zone E-3

Project Number 40042

Prepared by

MacKay and Somps, Civil Engineers
3000 Gordon Avenue
Santa Clara, California 95051

for

SANTA CLARA COUNTY FLOOD CONTROL
AND WATER DISTRICT

June 1973

SANTA CLARA COUNTY FLOOD CONTROL
AND WATER DISTRICT

DRAFT

ENVIRONMENTAL IMPACT REPORT

relative to

Flood Control Improvements

on

NORWOOD CREEK

from Thompson Creek to 13,000 feet upstream

Zone E-1 and proposed Zone E-3

Project Number 40042

June 1973

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General Manager

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ENVIRONMENTAL IMPACT REPORT
Relative to
Flood Control Improvements
on
NORWOOD CREEK

Table of Contents

Page

INTRODUCTION AND DESCRIPTION OF PROJECT 1

AUTHORITY 3

ENVIRONMENTAL SETTING PRIOR TO PROJECT 4

- General Description 4
- Geology 5
- Historical and Archaeological Qualities 9
- Ecology 10
- Land Uses 12
- Recreational Use 12
- Related Projects 13

ENVIRONMENTAL IMPACT OF THE PROPOSED PROJECT 14

Socioeconomic 14

- Community Goals and Plans 14
- Population Distribution and Concentration 14
- Recreational 15
- Public Health and Safety of the Proposed Construction. 15
- Economic 16
- Public Services 16
- Aesthetic and Scenic 16
- Historical and Archaeological Sites 17

Biological/Physical/Chemical 18

- Ecology 18
- Air and Water Quality 19
- Noise 20
- Geology 20

ADVERSE ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED IF THE PROJECT IS IMPLEMENTED 24

MITIGATION MEASURES PROPOSED TO MINIMIZE THE IMPACT 26

ALTERNATIVES TO THE PROPOSED ACTION 27

THE RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY 29

Table of Contents (continued) Page

IRREVERSIBLE ENVIRONMENTAL CHANGES WHICH WOULD BE INVOLVED IN THE PROPOSED PROJECT SHOULD IT BE IMPLEMENTED 30

THE GROWTH-INDUCING IMPACT OF THE PROPOSED PROJECT 31

IDENTITY OF AGENCIES AND INDIVIDUALS CONSULTED 33

APPENDIX A 34

Table I Observed Trees and Vegetation 34

INTRODUCTION AND DESCRIPTION OF PROJECT

The Norwood Creek flood control improvement project is located on the easterly side of the valley which forms the urban portion of northern Santa Clara County, California. A major portion of the Norwood Creek watershed is in unincorporated (County) territory and the balance is within the City of San Jose. The general location of the project is shown in Figure 1 and the topography of the project area is shown in Figure 2.

The creeks on the easterly side of Santa Clara Valley originate in the foothills and flow in defined channels until they reach the valley floor. As the grade flattens, many of the channels become nonexistent resulting in sheet overland flow. Because of this overland flow situtation, extensive flooding has occurred during periods of heavy rainfall.

The proposed project will pick up the North Branch and South Branch channels of Norwood Creek at the base of the foothills and, through the construction of downstream flood control improvements, will convey the flows to Thompson Creek, a distance of approximately two miles. In general, the improvements will include earth channel sections, rock-lined channel sections, buried concrete pipe sections, drop structures, energy dissipators and a sediment control facility. The design criteria and proposed construction plan are presented in greater detail in the accompanying engineering report.

The facility, when completed, will provide a level of protection against flooding adequate to safely convey a one percent flood - i.e., the so-called 100-year recurrence flood, to the point of outfall into Thompson Creek.

The proposed project, which for 75 percent of its length utilizes an underground conduit, provides a technically economically and feasible solution to the existing flooding situation. The portion of the project that is underground conduit will have a minimal environmental impact; however, the open channel sections as well as the sediment control facility will have more extensive environmental effects. Because construction of the flood control improvement will make possible the urbanization of area, the growth inducing aspects of the proposed project will be emphasized in this report.

This report has been prepared by the firm of MacKay and Somps, Civil Engineers, with the assistance and cooperation of the Santa Clara County Flood Control and Water District staff.

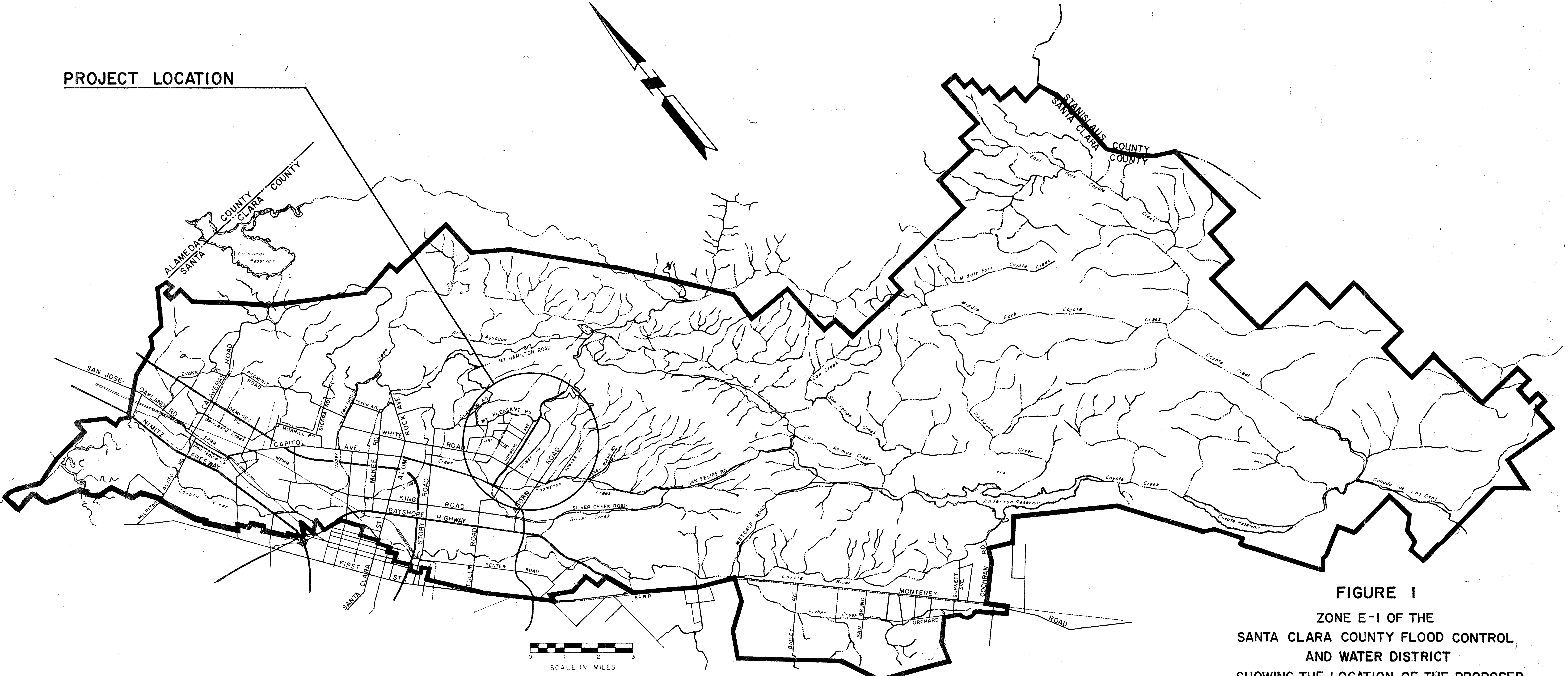
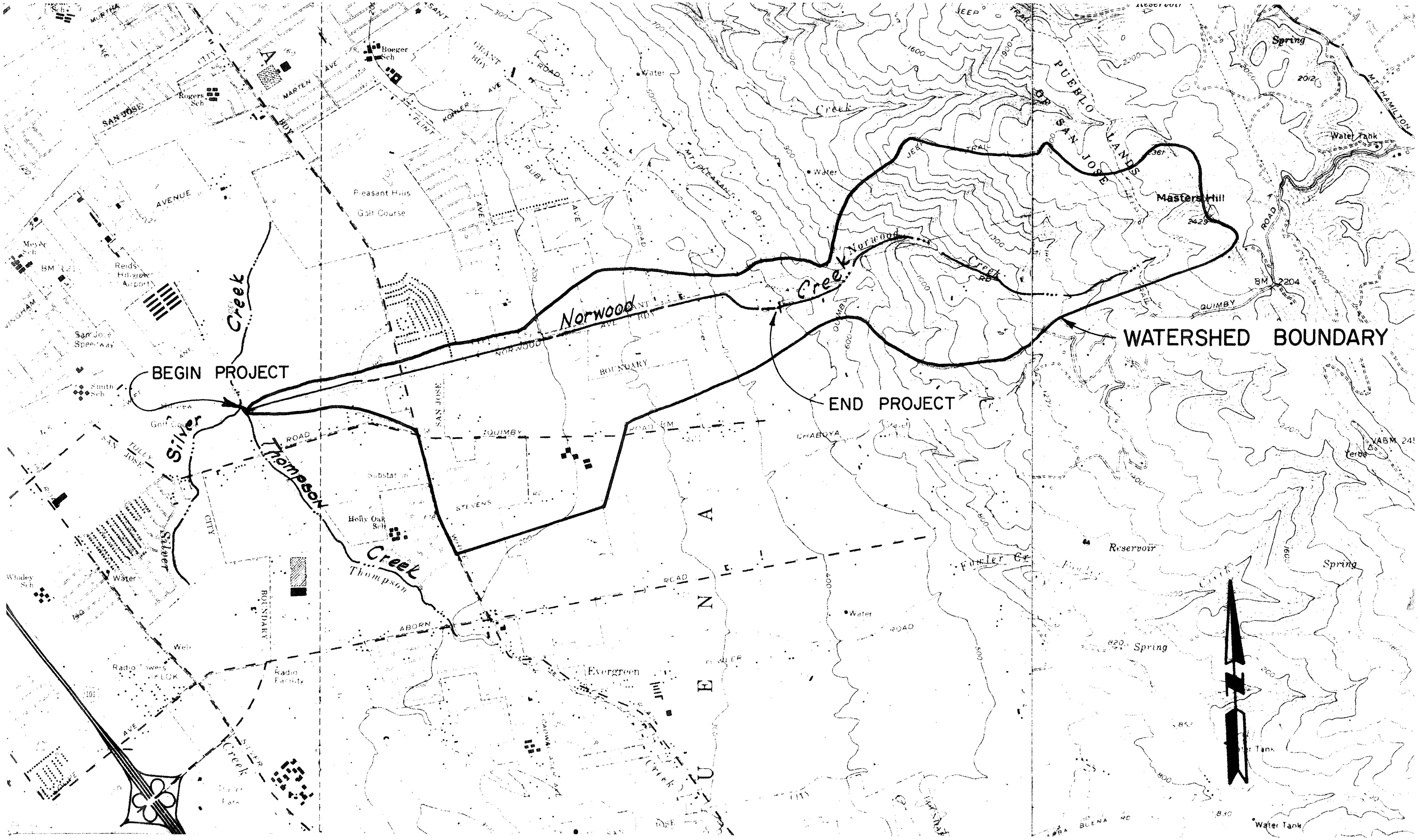


FIGURE I

ZONE E-I OF THE
SANTA CLARA COUNTY FLOOD CONTROL
AND WATER DISTRICT
SHOWING THE LOCATION OF THE PROPOSED
NORWOOD CREEK PROJECT



SCALE: 1" = 2000'

FIGURE 2

TOPOGRAPHICAL MAP

AUTHORITY

The Norwood Creek flood control improvements will be constructed by a joint venture of several developers under the terms of an agreement between the developer, the City of San Jose and the Santa Clara County Flood Control and Water District. This agreement was approved by the Board of Directors of the Santa Clara County Flood Control and Water District on April 17, 1973.

ENVIRONMENTAL SETTING PRIOR TO PROJECT

General Description

The Norwood Creek watershed has a drainage area of 2.25 square miles. About 60 percent of this area is in the steep foothills and the balance is relatively flat valley floor. At the present time there are only scattered homes in the watershed and the valley portion is primarily used for orchards or vineyards. The major existing streets in the watershed are Norwood Avenue and White Road. Some subdivisions are now being planned and it is anticipated that most of the valley floor area will eventually be developed into an urban community.

There are a few homes and other structures, primarily barns and sheds, in the immediate project area. The major portion of the census tract is currently agricultural open space with 2,164 households and a total population of 8,637 people, as of November 1972. Most of the housing developments are on 6,000 foot lots. The median income for this census tract is $13,150. The census tract (5033.02) is bounded on the east by the Capitol Expressway, on the north by Clayton Road, on the east by the PG&E power line and on the south by Aborn Road.

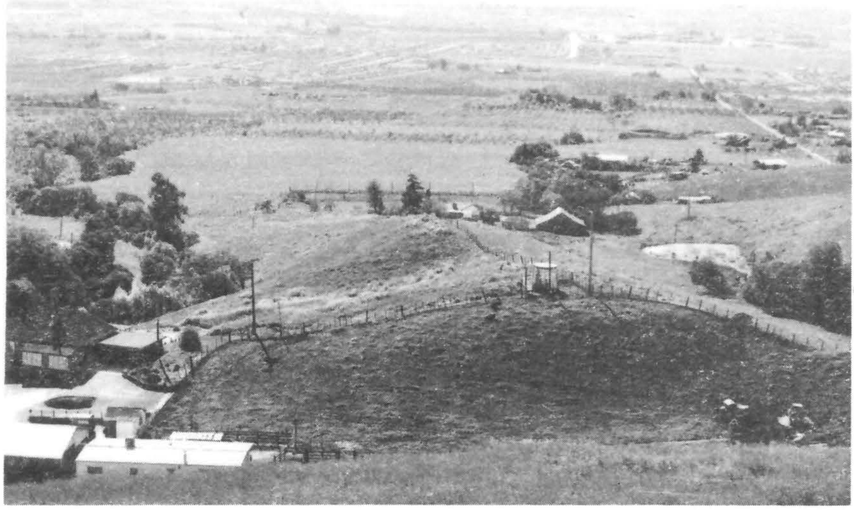
The project area has a diversity of native, naturalized and introduced flora. Both creek channels are densely foliated with native species which represent the remainder of the original plant communities before the encroachment by man.

The site of the proposed sediment control facility is an open meadow located between the two branches of the creek and is planted with native and introduced species used for livestock forage. Westerly of the meadow is a producing apricot orchard where the deeply entrenched creek bed flattens out and continues as a swale. Scattered older single-family residences are located along Norwood Avenue, increasing in density in the direction of White Road. The area adjacent to the earth channel is bordered by vacant land and the remainder of an apricot orchard, now used to grow fodder. Figures 3A and 3B show typical views of the project site and surrounding environs.

Geology

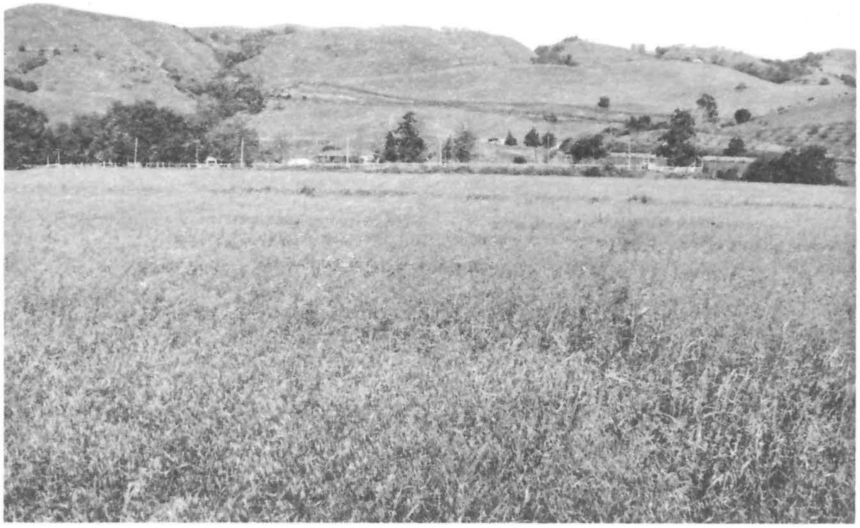
Topography

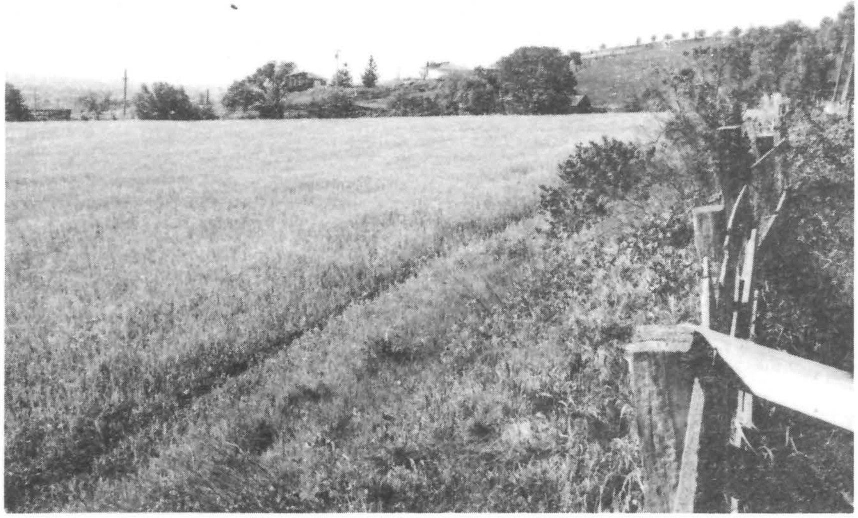
The project area consists of relatively flat valley floor ranging from less than one percent slopes at Thompson Creek up to more than eight percent at the easterly end of the project, i.e., at the base of the foothills. The Norwood Creek watershed is bounded on the north by the Ruby Creek watershed and on the south by the Quimby Creek watershed. There are two branches of Norwood Creek designated as the North and South Branches. Both branches originate in the foothills with the drainage area of the northerly branch shed extending above the 2400-foot elevation level. The total watershed area is small, about 2¼ square miles, but has a high



Overview of entire project area looking west from Quimby Road. Norwood Avenue is on the right. Sediment control facility site is in center (in the meadow).

Sediment control facility site, showing both inlet channel sites looking east.

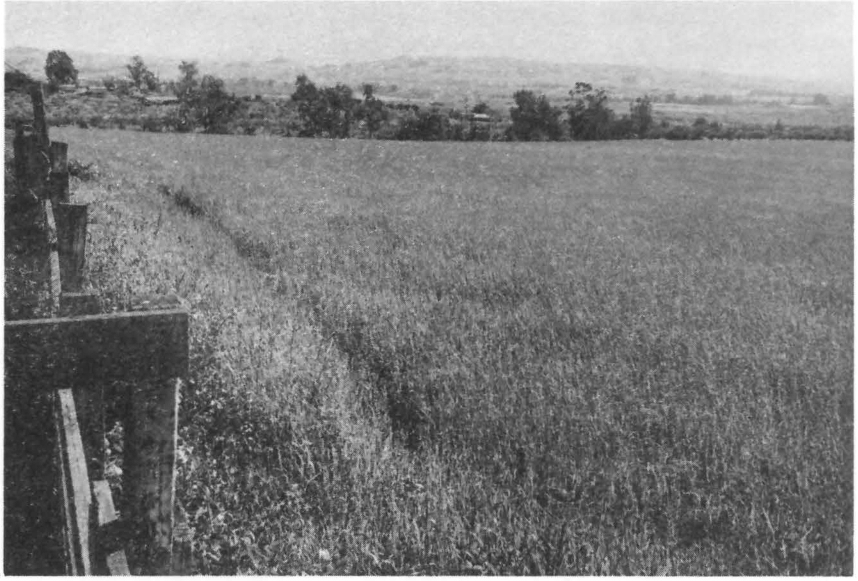


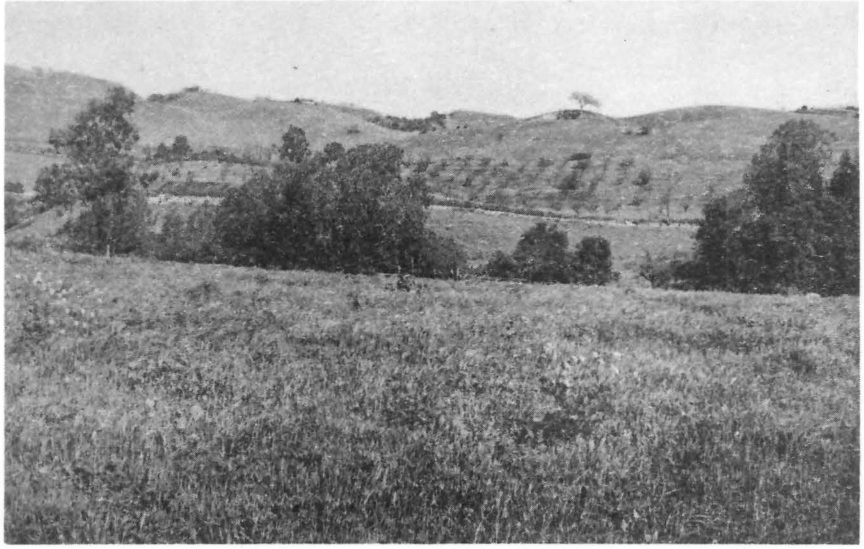


Looking NNW directly across the sediment control facility site. Note west corral fence (right).

FIGURE 3A

South Norwood Creek branch taken looking SSW across sediment control facility site.





Site of inlet channel of sediment control facility, looking SE.

Site of underground conduit. Norwood Avenue looking west from the Ruby Avenue intersection.

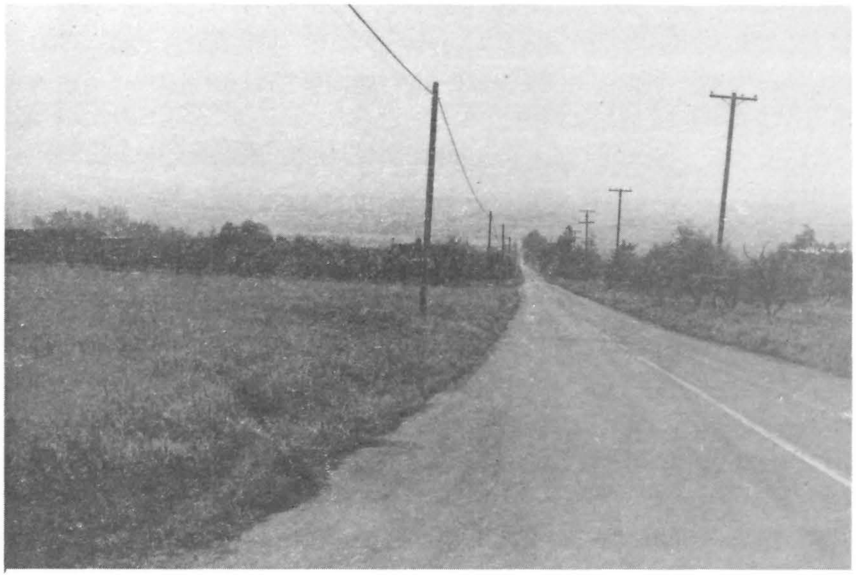


FIGURE 3B

flood potential because of the steep slopes in the foothills and the lack of defined channels in valley portions.

Geology and Seismicity

From a geologic standpoint, and for the sake of simplicity, the drainage basin of Norwood Creek can be divided into two segments: the upland area and the alluvial fan area.

1. Upland Area - The upland area is underlain by older consolidated rocks. Stream gradients are steep, mostly greater than 20 percent, with the stream actively eroding the underlying rocks of this portion of the drainage basin. The eroded material is carried from the upland area by the waters of Norwood Creek, mostly during flood flows, onto the alluvial fan area and Santa Clara Valley where the material is deposited. The stream channel within the upland area is well developed and, in most places, deeply incised into the bedrock. Infiltration rates from the surface water of the stream to the underlying bedrock of the upland area are negligible. Groundwater yields to wells in the upland area are small and are sufficient only for domestic and stock watering purposes.
2. Alluvial Fan Area - The project is located in the alluvial fan area of the basin where the stream emerges from the upland area onto Santa Clara Valley. The fan

is one of numerous and coalescing alluvial fans which comprise Santa Clara Valley and its underlying groundwater basin. The apex of the fan is located at the edge of the valley while the terminal end of the fan merges indistinguishably with that of adjacent alluvial fans in a zone east of White Road.

Stream gradients in the alluvial fan area are moderate, averaging about 6 percent, and much less than gradients in the upland area. As a result, the sediment carrying capacity of Norwood Creek is reduced drastically upon its entry onto Santa Clara Valley and the bulk of the eroded material that can no longer be carried by the stream is deposited to form an alluvial fan.

The channel of the stream in the alluvial fan area is very shallow in comparison to the deeply incised channel of the upland area. The channel is only a few feet deep at the apex of the fan becoming shallower at the downstream end of the fan. The channel loses its identity about one mile downslope on the fan. The channel has frequently changed its location over a crude arc-shaped area since its formation about one million years ago. The changes in location are due to the stream channel being choked and filled with its own sediment and thus forcing the stream to an adjacent lower elevation.

The result of the project will be to keep the stream in one channel which, in turn, will eliminate the threat of flooding on the alluvial fan.

The depth of the alluvial fan deposits is variable and varies from tens of feet at the apex of the fan to perhaps over 600 feet at the digital portions of the fan where a steep drop-off of bedrock occurs. A bedrock protrusion through the alluvial deposits occurs immediately south of the channel and about 4000 feet downslope from the apex of the fan.

The project is in a highly active seismic zone within the active Calaveras-Hayward fault system. The project crosses at least two concealed and older fault traces of the fault system at right angles. The area was the epicenter of two unusual earthquakes which occurred July 19, 1925 and May 28, 1927, with Rossi-Forcel scale intensities of III and VI, respectively.

Climatology

The mean annual precipitation of the Norwood Creek watershed varies from a high of 24 inches in the foothills to a low of 14 inches in the vicinity of the confluence with Thompson Creek. Almost all of the measurable precipitation occurs during the months of October through April.

Hydrology

There is no specific stream flow data existing in the Norwood Creek watershed. However, actual experience (for example, seasonal flooding at times of heavy rainfall) is indicative that there is a serious need for the project improvements.

Anticipated peak design flows vary from 70 cfs on the South Branch and 320 cfs on the North Branch at the upper end of the project to 420 cfs at the downstream end of the project. These figures are based on a one percent design flood flow.

Historical and Archaeological Qualities

There appears to be evidence of an old stage coach stop on the property adjacent to and northerly of the sediment control facility. The site, although presently owned by the District, will not be affected by the project.

Also, approximately one mile southerly of the project area off Aborn Road is the Mirassou Winery, surrounded by some 300 acres of vineyards. This winery was originally established in 1854. The present buildings were constructed in 1937 and the present vineyards as early as 1909.

There are no known archaeological sites within the immediate area of the project.

Ecology

Flora

1. Trees and Vegetation - The creek channels can be characterized as modified Oak Woodlands with the Coast Live Oak (*Quercus agrifolia*) as the major species of oak represented. The vegetation along the creek slopes varies from dense brush, primarily Pacific Poison Oak (*Rhus diversiloba*) to annual grasses.

North Branch: The North Branch of the project reach is most notably dominated by Coast Live Oak and California Laurel or Bay (*Umbellularia californica*). The eastern end of the channel is far denser in foliage coverage (both trees and bushes) than the western portion, corresponding to the steepness of the slopes. As the creek channel flattens out, the vegetative cover of the area drops off considerably to essentially blend in with the surrounding meadowland, interspersed with an occasional tree or bush. A complete listing of the observed trees and vegetation of the entire area is included in the Appendix (Table 1).

South Branch: The creek channel of the South Branch is dominated to the east by a single large Eucalyptus tree (*Eucalyptus globulus*) about 60 feet tall and approximately 3 1/3 feet in diameter and several large stands of California Laurel or Bay. The ground cover along the channel is more sparse in the South Branch than that of the North Branch, consisting primarily of annual and perennial herbs.

Valley: The area between the North and South Branches has been artificially kept in a state of primitive secondary succession by the landowners for the purpose of growing livestock feed. The predominant species of note are Wild Oats (Avena sativa), Garden Radish (Raphanus sativus), Field Mustard (Brassica campestris) and California Burclover (Medicago hispida). The meadow also flourishes with numerous other species of wild flowers, annuals and perennials too young to accurately identify so early in the growing season.

Table 1, Appendix A, lists the observed vegetation in greater detail.

Fauna

Since there are two basic types of plant communities within the site, namely Oak Woodlands and modified grassland, the associated animal species can be expected to vary accordingly. Although neither of the areas are in a pristine state, many native species of wildlife still inhabit these communities. The Oak Woodlands characteristically have several species of birds and animals associated with them, the Acorn Woodpecker (Melanerpes formicivorous), Rufous-sided Towhee (Pipilo arythrophthalmus), Scrub Jay (Aphelocoma coerulescens), White-breasted Nuthatch

(Sitta carolinensis), Brush Mouse (Peromyscus boylei) and California Ground Squirrel (Citellus beecheyi) as more or less permanent inhabitants. The modified grasslands area is likely to support several species of wildlife among which are the Botta Pocket Gopher (Thomomys bottae), Western Harvest Mouse (Reithrodontomys megalotis), Deer Mouse (Peromyscus maniculatus), and California Meadow Mouse (Peromyscus californicus) which can support Red-Tailed Hawks (Buteo jamaicenis). Also to be found are Robins (Turdus migratorius), Brewer Blackbirds (Euphagus cyanocephalus), Western Meadowlarks (Sturella neglecta), Western Grasshopper Sparrows (Ammodramus savannarum) and English Sparrows (Passer domesticus), all of which are dependent on the abundant supply of seeds and insects in the area.

Land Uses

There is a limited amount of urban residential development northerly and southerly of the project area. There is also a small amount of commercial development in the southwest corner of the project area. The central portion of the project area consists of scattered residential uses, most of which are related to the present agricultural uses of the properties.

Recreational Use

There is presently no recreational use of the existing creek area other than the open space aspect of the areas proposed for the earth channel and sediment control facility portions of the project. There are properties within the project area owned by or reserved for the City of San Jose Parks and Recreation Department for future park facilities.

Related Projects

There are projects similar to the proposed project planned by the Santa Clara County Flood Control and Water District. Two of these projects are on adjacent watersheds, i.e., Quimby Creek to the south and Ruby Creek to the north. These projects are, however, independent of the proposed Norwood Creek project although it is probable that if the Norwood Creek project is completed as proposed, it may provide a basis for construction of other projects in adjacent areas having similar conditions.

ENVIRONMENTAL IMPACT OF THE PROPOSED PROJECT

Socioeconomic

Community Goals and Plans

The impact of the proposed work on the community will be favorable in terms of reducing the flood hazards. The project is designed for the one percent flood, thus giving the required assurance necessary to permit continued development of the Evergreen Valley. Such development is in accordance with the City of San Jose's General Plan and the City's proposed Evergreen Area Plan. It is also within the City of San Jose's recommended urban growth area as delineated in the Urban Development Policies adopted in April 1972. The need for the project will increase as urban growth occurs. Prior to complete urbanization of the area, the project will control the existing flood hazard which threatens to bring financial and/or physical loss to the agricultural uses as well as some of the adjacent residential uses in the affected area.

Population Distribution and Concentration

The area of the proposed project has been identified by the City of San Jose's Urban Development Policy as an area which shall be encouraged for development.

Development of residential uses has already been rather extensive adjacent to the project area with primary concentrations on the north side of Norwood Road and on the southerly side of Quimby Road.

Recreational

The project itself will not provide recreational uses however, the completion of the project will make possible the development of nearby park areas. Some of these park areas have already been acquired and/or reserved for the planned residential growth of the area.

The maintenance roads along the proposed channel improvement could be utilized as a part of a park or bike trail system. This use, of course, will be subject to agreement between the District and other appropriate public agencies.

Public Health and Safety of the Proposed Construction

The actual construction of the proposed project will create certain hazards to people who are walking or driving along the roads adjacent to the project, or children who might be playing near the construction area. These hazards will be typical of construction activities involving trench and channel excavation adjacent to existing roads and residential areas. Construction companies are required by law to provide protection by employing proper barricades, fencing and traffic controls, pedestrian controls and similar safeguards. In addition to the existing safety practices, the project specifications will include specific requirements pertinent to this specific project for the health and safety of residents in the project area.

Economic

The total cost of the project, estimated to be approximately $1,371,000, is to be financed by private capital advanced by owners of a major portion of the properties included in the proposed flood control Zone E-3. In the future, as other properties in the zone develop, these developments would be required to reimburse those advancing the capital for their share of the project cost. There will be no cost to the general public through taxes, etc., to finance the project construction.

Public Services

All public services are presently existing in or are adjacent to the project area including such utility services as water, gas, electricity and sewers. In addition, school and park sites are or will be reserved for future purchase and development as the growth of the area requires. Inasmuch as adequate flood control protection is not presently existing in the area, the proposed project will provide the primary drainage facility required to serve the area of projected growth.

Aesthetic and Scenic

Approximately 75 percent of the project consists of underground flood control facilities which, when completed, will not permanently affect the aesthetic and/or scenic qualities of the area. Some orchard trees will have to be removed in the upper reaches of the underground portion to facilitate construction, but these will be in the central portion of the orchard and consequently the visual impact will be minimal.

The channel portion of the project where the South and North Branches of Norwood Creek are realigned will require the removal of some significant (over 6 inches diameter) trees. The earth channel and sediment control facility, both of which will be enclosed with a 6-foot chain link fence, will have a major visual impact on the area. The earth channel in the lower reach of the project, i.e., from White Road to Thompson Creek, will cross an empty field. The single oak tree growing within the right of way will be preserved. To mitigate the barren appearance of the earth channel, trees and shrubs will be planted along the proposed channel improvement.

The sediment control facility will require some cutting and filling to create the basin; slopes created by the construction will be seeded with grasses to soften the appearance of the structure and provide some erosion control. In addition, trees and shrubs will be planted along the slopes to give the facility a more natural appearance and to provide a screening effect.

Historical and Archaeological Sites

The proposed project will not directly affect any known historical or archaeological sites. However, as previously mentioned, there is evidence of an historical stage coach stop including some remnants of the original buildings. This is on property presently owned by the District and is located just northerly of the proposed sediment control facility. The District will assume the responsibility of consulting with local historical societies should future activity affect the status of the site.

In the event that artifacts are discovered during construction, the District will consult with qualified experts to ensure their protection and preservation.

Biological/Physical/Chemical

Ecology

The section of underground conduit which will be placed under the orchard will necessitate the removal of approximately 60 apricot trees.

Construction of the sediment control facility will result in the excavation of about seven acres of a meadow currently being used to grow oats for fodder. The inlet channels of the basin will intersect a section of both the North and South Branches of Norwood Creek and result in the removal of approximately one-third acre of profuse underbrush and 27 significant trees. Trees to be removed along the South Branch include five Blue Elderberry, two Coast Live Oak, one Buckeye, nine Bay and one Walnut. The earth channel will have only a minor ecological impact because it will be located in a presently vacant field. Both slopes of the earth channel as well as the banks of the sediment control facility will be landscaped with trees, shrubs and ground cover which will compensate, in part, for the loss of vegetation as a result of the total project.

The landscaping program will partially offset the loss of vegetative habitat resulting from the project. Although some birds and wildlife may be driven from the area during construction, most species should reestablish themselves in the area upon completion of the project.

Of even greater concern from an ecological standpoint are the inevitable secondary effects of the project. With the project's completion and with the subsequent resolution of the area's school classroom deficiency, urban growth is likely to be accelerated. The transition from a semirural, agricultural area to full urban use will gradually alter the existing plant and animal communities of the region.

Air and Water Quality

Except for the slight reduction in the natural percolation of waters into the soils during the rainy seasons, the project will not directly have a major effect on air and water quality. For a limited time, the construction activity will produce an increase in dust in the atmosphere. Good construction practices will be used to limit this occurrence to a minimum.

The secondary effect of the project, i.e., the subsequent urbanization of the area, will invariably affect the quality of the air by contributing air pollutants to the airshed of the region. Similarly, the quality of the water runoff from developed areas will be somewhat reduced as compared to the natural runoff from the land.

Noise

Only the equipment and related activities of the construction of the proposed project will have an effect on normal noise levels of the region. This activity would occur only during the normal working hours of the day and would cease upon completion of the project. Subsequent urbanization will increase the noise levels of the area.

Geology

1. Slope Stability - The project is expected to have only a very minor effect on the slope stability of the area. Depending upon the design of the project, the only possible slope stability problems will be minor sloughing along the banks of the channel and the slopes of the sediment control facility.

2. Subsidence - The District's records indicate that groundwater levels in this area have been relatively deep for a considerable period of time and were, perhaps, deep even prior to the intensive use of groundwater which began at the turn of the century. The underlying sediments which are susceptible to subsidence appear to have already been compacted and negligible subsidence is expected to occur due to the effects of the project.

3. Geohydrology - The project will have an effect on the geohydrology of the area although this effect can only be crudely estimated because of the limited data available relative to present conditions.

Most of the effect will be on the amount of recharge to the groundwater basin. The plans call for a small sediment control facility upstream of the project and a pipeline to carry water from this facility to White Road. Downstream from White Road the flood water will flow in an earth channel. Since recharge now occurs in the area where the flood waters will be conveyed by pipeline, the project and the subsequent urban development will probably result in a lowering of water levels which are already low in portions of the fan.

The anticipated lowering of the groundwater levels may affect groundwater quality. Some connate water (salt water found in marine deposits) has been reported in deep wells in the Evergreen area. The source of the connate water is apparently the underlying bedrock. Contamination of wells with this water may occur if water levels are sufficiently lowered allowing invasion of the connate water into the lower portion of the alluvial deposits.

Groundwater movement of the area appears to be very complex but generally parallel to surface flow. The direction of movement is not expected to be affected by the project.

4. Erosion and Sedimentation - The project will have a beneficial effect on erosion and sedimentation in the area. Almost all of the sediment is now deposited in the alluvial fan. Upon completion of the project, the sediment not trapped by the sediment control facility will be carried downslope to Thompson and Silver Creeks.

5. Seismicity - The damaging effects of an earthquake are generally due to earth shaking and surface rupture. The probability of a moderately large earthquake emanating nearby from either the Hayward-Calaveras or San Andreas fault systems during the lifetime of the project is large. The project may be badly damaged due to earth shaking but the presence of the project itself should not cause significant damage to adjacent property providing there is no failure of the sediment control facility and pipeline. Since groundwater levels are generally low and few unconsolidated near-surface silt and fine sand deposits occur beneath the project, no significant liquefaction and/or settlement is expected to occur due to shaking. The probability of surface rupture occurring at any time across the project is low during the life of the project and very low for rupture during flood flows.

6. Hydrology - Since the project is a flood control facility, its net effect will be to more efficiently control and transmit flood waters from the foothills to the major water courses downstream. There presently are some existing downstream problems such as currently existing flooding problems along Silver Creek.

The improvement of Norwood Creek in advance of the improvement of Silver Creek for some distance below the confluence of Norwood and Thompson Creeks will adversely affect the existing flooding condition in and along Silver Creek. Although the degree of this impact is presently unknown, the District is currently evaluating the effect on this flooding condition as a result of the improvement on the channels tributary to Silver Creek upstream of Cunningham Avenue.

ADVERSE ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED IF THE PROJECT IS IMPLEMENTED

It is judged that the following adverse effects will result from the proposed project:

- Removal of approximately 60 fruit trees from a producing orchard due to construction of the underground conduit;
- Excavation of approximately seven acres of a meadow used for growing fodder due to construction of the sediment control facility. The inlet channels of the basin will require the removal of 27 significant native trees and approximately one-third of an acre of heavy underbrush from the banks of Norwood Creek (North and South Branches).
- Construction of visually unaesthetic structures, including an earth channel, a sediment control facility and the chain link fence surrounding these features of the project*;
- Increased flood flows will occur along Silver Creek as a result of the proposed flood control improvements to Norwood Creek.
- Loss of groundwater recharge capacity resulting from placing water flowing in the stream in an underground conduit;
- Creation of hazards and disruption of neighborhood due to construction activities*;
- Increased demands on public services such as schools,

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*Subject to mitigation measures.

police, utilities and highways resulting from eventual addition of population to the area;

- Adverse effect on the quality of the surrounding environment due to urbanization of the area.

MITIGATION MEASURES PROPOSED TO MINIMIZE THE IMPACT

The area of most concern from an aesthetic standpoint will be those portions of the project open to public view, i.e., the earth channel section and the sediment control facility. The inclusion of trees, shrubs and a grass planting program as mitigating measures will reduce the visual impact of these exposed facilities. In time, the vegetation will become established and the barren terrain created by construction of these structures will appear more natural. The sterile appearance of the chain link fence will be mitigated somewhat by the use of green color-coated fencing.

The landscaping program will replace a portion of the wildlife habitat lost due to the removal of trees and vegetative ground cover.

Improvement of Silver Creek below the confluence of Norwood and Thompson Creeks prior or simultaneous to the proposed project could eliminate the impact on Silver Creek.

The impact on the neighborhood imposed during the construction phase of the project will be minimized by specifications requiring the Contractor to adhere to measures which control disturbances and disruptions such as noise, dust and increased traffic.

ALTERNATIVES TO THE PROPOSED ACTION

During the planning stage of the project, several alternatives were considered that would also provide adequate flood protection in the area.

One alternative design considered was the use of either a concrete-lined channel or rock-lined channel over the entire length of the project. This alternative, however, was more expensive than the proposed plan and would have a more damaging effect on the environment compared to placing a portion of the channel in pipe under Norwood Avenue. A sediment control facility would still be required with this alternative to preclude silt deposition and the consequent reduction in flood carrying capacity in the flatter downstream reaches. Erosion problems on the lining could occur if gravel and debris were not kept out of the channel.

An earth channel was also considered over the whole project length rather than just from the Thompson Creek confluence to White Road. This alternative would not only have a greater environmental impact of the area compared to the proposed project but it would be more expensive since the steep ground slope would require a large number of drop structures upstream of White Road. Although the earth channel could be landscaped to mitigate its effect on the environment, the drop structures would have a more adverse effect on the environment both visually and from the standpoint of creating a public hazard because of the high amount of turbulence occurring during flood flows. The one advantage of this alternative would be that the sediment control facility could be moved further downstream from its present location to one that would perhaps have a lesser visual impact on the area. In this alternative, consideration was also given to the possible use of drop structures to act as debris retention structures and not have an actual sediment control facility. However, this would probably require constant excavation of the debris and sediment deposited from the earth channel with consequent higher maintenance costs.

Another alternative that was considered was using the proposed plan but without the sediment control facility. This plan, however, could create a very hazardous situation as the pipe could become blocked with debris and sediment which could result in flooding of the surrounding area. The cost of periodically removing this material from the pipe could approach the cost of the original installation. Therefore, this was not considered a sound alternative either from a public welfare or from an economic point of view.

The alternative of "no project" would allow a continuation of the existing flooding conditions of the area and consequently the planned urbanization of the area could probably not occur.

THE RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

Flood control projects are constructed to assure that drainage facilities function to the benefit of the area and thereby minimize and hopefully eliminate flood hazards. Providing protection against flooding is a normal element of land use and is, in addition, an essential element in the process of changing land uses presently contemplated. Although a smaller facility might be constructed to resolve this seasonal condition, this is not practical when one considers the long-term planned urbanization of the region.

Construction of the facility at an early stage of urbanization allows construction at the lowest possible cost and with the least inconvenience to the surrounding community.

It is true that not constructing such facilities would postpone, perhaps forever, the development of the area and thus maintain a portion of these lands as agricultural open space.

It is also true, however, that housing must be provided for the people of Santa Clara County and if this is to be provided, then the areas appropriate for housing are those areas where public services are available and where urbanization is planned and/or in progress. Norwood Creek area is such an area and only proper flood control facilities are presently impeding development. Construction of the proposed channel improvements would, therefore, irrevocably commit the project area to urban development.

IRREVERSIBLE ENVIRONMENTAL CHANGES WHICH WOULD BE INVOLVED IN THE PROPOSED PROJECT SHOULD IT BE IMPLEMENTED

The primary effects of the flood control project will be the construction of a flood control channel and the sediment control facility, both of which involve permanent structures and constitute significant and irreversible environmental changes to the present open, and in some areas, natural landscape. The project would also remove a quantity of productive fruit trees as well as some significant native trees and vegetation.

The second type of change associated with the project relates to the multitude of effects resulting from urbanization of the area subsequent to providing flood control improvements. Development of the area from primarily agricultural land uses to residential and commercial uses involves a local and regional commitment of nonrenewable resources to support the projected population growth.

THE GROWTH-INDUCING IMPACT OF THE PROPOSED PROJECT

The implementation of this proposed flood control project would have a growth-inducing impact in the area bounded by the proposed Flood Control District Zone E-3. This project will provide the only public utility service facility not already available. Since all required services will then be available and since the area is within the limits of the City of San Jose's adopted urban development policy, planned growth can be expected to occur.

Based on the City of San Jose's Evergreen area plan, one can expect ultimately an estimated 2,200 residential units or approximately 8,000 inhabitants in the proposed E-3 Zone between White Road and the foothills. In addition, there are three elementary schools, one high school and two neighborhood parks planned for this area. Sites for most of these have already been acquired and/or reserved. The current City Ordinance recently initiated by referendum (Ordinance No. 16764), states that in areas where schools are inadequate, the Developer may "provide a satisfactory temporary alternative to permanent school construction".

It is obvious that it will take many years to attain full development of this area; however, 50 to 70 percent of the ultimate population growth for the above designated area can be expected within the next six years. Thus, by providing flood control facilities, accelerated residential development can be anticipated.

The completion of the proposed flood control project will probably encourage similar projects in the area; however, each such project must be considered on its own merit.

IDENTITY OF AGENCIES AND INDIVIDUALS CONSULTED

1. Santa Clara County Flood Control and Water District
   5750 Almaden Expressway
   San Jose, California 95118

2. City of San Jose
   801 North First Street
   San Jose, California 951110

3. Shappell Industries of Northern California
   1287 Lawrence Station Road
   Sunnyvale, California 94086

APPENDIX A

TABLE I OBSERVED TREES AND VEGETATION

(Feb. and March, 1973)

TREES AND SHRUBS

Coast Life Oak	*Quercus agrifolia*
California Laurel or Bay	*Umbellularia californica*
Eucalyptus	*Eucalyptus globulus*
Blue Elderberry	*Sambucus cerulea*
California Toyon	*Heteromeles arbutifolia*
Pacific Poison Oak	*Rhus diversiloba*
Coyote Bush	*Baccharis pilularis*
California Buckeye	*Aesculus californica*
Sage	*Salvia sp.*
Scrub Oak	*Quercus dumosa*

MAJOR GROUND COVER PLANTS

Milk Thistle	*Silybum marianum*
Common Snowberry	*Symphoricarpus albus*
Common Wild Cucumber	*Marah fabaceus*
Field Mustard	*Brassica campestris*
Wild Radish	*Raphanus sativa*
Red-Stem Filagree	*Erodium cicutarium*
Shepard's Purse	*Capsella bursa-pastoris*
California Burclover	*Medicago hispida*
Poison Hemlock	*Conium maculatum*
Wild Oats	*Avena sativa*
Buckthorn Weed	*Amsinckia douglasiana*
Mouse Barley	*Hordeum murinum*
Common Blackberry	*Rubus vitifolius*
Scarlet Pimpernel	*Anagallis arvensis*